

The 'Search & Rescue' Game

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Background

Japan is vulnerable to natural disasters, such as annual floods, landslides, earthquakes, and so on. One such disaster, the Great Hanshin Awaji Earthquake, occurred at 0546 h on January 17, 1995. The earthquake had a magnitude of 7.2 and its epicenter was right beneath Kobe, one of the biggest cities in western Japan, with a population of 1.5 million. The earthquake shocked Kobe severely, with a JMA Intensity of 7, the maximum value on the Japan Meteorological Agency (JMA) seismic intensity scale.

The damage was widespread in terms of lives, property, and infrastructure. More than 6,400 people were killed and 15,000 injured. At least 200,000 buildings were damaged or destroyed; 400,000 people were left homeless and 240,000 people sought public shelter. Fires consumed about 450 hectares of Kobe, and there was widespread damage to road, water, gas, and sewer systems. The Port of Kobe was heavily damaged and took months to repair. Eight-five percent of the schools were damaged, and the city hall, many hospitals, and other major public facilities sustained heavy damage. Small and medium-sized businesses were hit hard. The total economic loss is estimated at US\$150 billion, with more than US\$100 billion in property damage.

Unfortunately, it will not be the last earthquake disaster to strike Japan. Japanese seismologists agree that based on historical data, another catastrophic earthquake will occur within the next twenty to thirty years, and may hit the Kansai, Tokai, and Tokyo areas simultaneously in a worst case scenario. Although it is true that the Japanese have learned many lessons from the tragedy of the Great Hanshin Awaji earthquake, two crucial problems that are closely related remain unsolved.

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First, human, technical, and financial resources will be too scarce compared with the estimated damage if the next big earthquake occurs anywhere near an urbanized area because of the high population concentration, as damage increases with population. Although the scarcity of resources for disaster response is widely recognized, few steps have been taken to improve this situation. One reason for this, at least from the perspective of administrative officials, is that it is unrealistic to allocate resources to prepare fully for major earthquakes, which occur much less frequently than other disasters, such as typhoons, landslides, and floods. Officials judge that it is more cost effective to prepare for more common events, which usually cause less damage. Consequently, there has been little progress in allocating resources to prepare for a major disaster from the perspective of government officials in general, and local government in particular.

Second, given this evident scarcity of resources, self-help and mutual aid among communities will be extremely important for any victims, both in disaster-prone areas in particular and elsewhere in Japan. Nevertheless, the populace may not be aware of the inadequate disaster response capability. This lack of awareness might result from a lack of proper information, as well as a general tendency to ignore risks. In reality, despite the immense, tragic damage caused by the Hanshin Awaji Earthquake Disaster, interest in earthquake disaster reduction among the Japanese in general seems to have faded quickly in recent years. This indifference among the populace could result in a serious problem, as it may preclude people from preparing for future earthquakes.

This tendency of people to subjectively reduce or ignore risks, in particular, personal risks, is known as optimistic bias (Weinstein, 1980). Real-world examples include the reluctance of inhabitants to evaluate disasters and patients' disobedience with respect to life-style related diseases, such as diabetes and hypertension. Consequently, efforts to improve preparedness for disasters such as earthquakes may fail because of this tendency.

Many training measures have attempted to overcome these two difficulties. Their effectiveness is still questionable, as indicated by the relatively low level of participation in disaster-prevention training, which is practiced commonly and periodically in Japan. We therefore need to develop other ways of training that are more effective than current practices.

In summary, new ways of preparing for low-frequency, high-impact disasters, emphasizing education and training both for lay persons and administrative officers, are necessary. We explore this in the following section.

Gaming Simulation as a tool for disaster mitigation

We propose gaming simulation as a promising tool to prepare both people and government officials for disasters. We envision the following three advantages of gaming simulation as a tool for disaster mitigation.

First, although our gaming simulation is not just a 'game' for fun in the strict meaning of the word, participants would associate the word 'game' with fun, in-

creasing the likelihood that the game would stimulate players to learn and induce active participation in education concerning disaster impact mitigation. Education concerning disaster impact mitigation is usually too scientific for laypersons, who find it too boring; however, a gaming simulation can overcome this difficulty.

Second, players would spontaneously be made aware of their lack of knowledge or understanding of disaster management through discussion during the game and a debriefing period after the game. This eye-opening experience should result in enduring, practical knowledge of the disaster reduction process. If there is a very long period between the occurrence of natural disasters, typical education regarding disaster impact mitigation may have little reality for those who lack direct experience confronting such disasters. Gaming simulation can provide a series of simulated experiences, thereby overcoming, or at least reducing, this difficulty.

Third, from the perspective of government officials, since gaming usually contains a strategic element, it offers a very suitable way for government officials to improve their decision-making capabilities before and during any crisis.

The 'Search & Rescue' game as a tool for disaster impact mitigation by experts

Figure 1 shows our schematic understanding of gaming simulation for disaster mitigation at present. The bar on the left shows that, as one approaches the top of the hierarchy in an organization or community, as in the case of the commander in the second column from the left, decision making takes on the nature of strategy. The word 'strategy' means decision-making regarding the irrevocable allocation of precious resources to achieve the intended goal.

In the event of a disaster, it is important to allocate resources appropriately, such as disaster response personnel in various roles, *i.e.*, the incident commander, and operations, planning, logistics, and administration/finance personnel. For the rescue department, the triage of victims is particularly important. The 'Search & Rescue' game described below emphasizes and realizes the need for strategic responses.

Descending the hierarchy to the staff level, decision making shifts to the nature of tactics. We use the word 'tactics' for decisions as to how an intended goal can be achieved with the resources allocated. In crisis, staff are often expected to respond and report, rather than behave independently, in a crisis. This can lead to efficient management of the crisis. Therefore, exercise drills can be the best way to learn how to manage a crisis situation. Typical examples are fire drills and evacuation drills.

There is an intermediate level of officers between the commanders and the staff. Decision making at this level involves a mixture of strategy and tactics. The most appropriate way for officers at this level to learn how to manage possible situations may be to study relevant manuals, and repeated review of crisis management manuals is a first step. Once they have a thorough knowledge of such manuals, the

officers will then be more able to handle crisis situations. We will introduce an example of such learning later.

The ‘Search & Rescue’ game as a tool for disaster impact mitigation by citizens

Figure 1 also depicts the importance of gaming simulation for citizens. As mentioned earlier, gaming simulation can stimulate active participation by citizens, *i.e.*, laypersons. Although citizens are not strictly categorized hierarchically as disaster responders, in reality there might be a rather loose hierarchy. For example, some people often exert considerable influence in a community. These people are either formally designated community leaders or are informal ‘opinion leaders’.

As with experts, drills are suitable for ‘lower’ levels, presumably the majority of people, whereas gaming simulation is suitable for the ‘upper’ level of citizens. In this sense, there is a good chance that a ‘Search & Rescue’ game originally designed for experts can also be used by citizens. We will not consider this here, but should mention that citizens’ experience of such ‘Search & Rescue’ games designed for experts can help them to understand the situation from the perspective of the experts. For example, while role-playing a commander and learning how experts triage an enormous number of disaster victims, citizens will unconsciously learn the importance of self-help and mutual aid in the community.

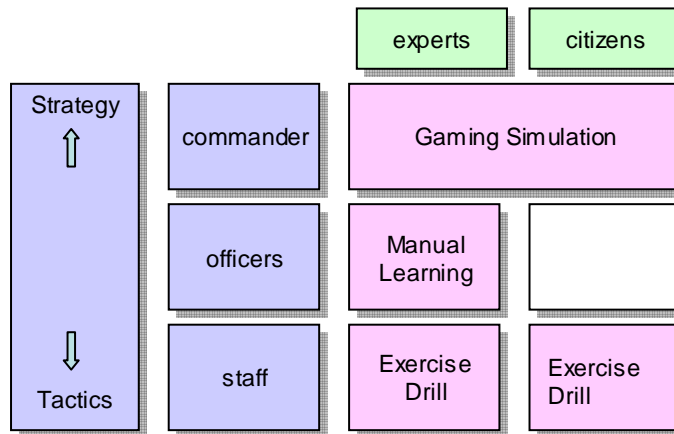


Figure 1 A schematic understanding of gaming simulation for disaster mitigation

The 'Search & Rescue' game

Our 'Search & Rescue' game aims to improve the capability of government officials to deal with crisis situations in the event of disasters. In this presentation, we introduce three versions of the game.

The first version adopts the style of a traditional Japanese board game 'Sugoroku'. The basic rules of Sugoroku are similar to those of the 'Game of Life' in that dice are used to run the game. Compared with other board games of this kind, the rules are much simpler, so anyone can play after a brief introduction of the rules.

This is an advantage to adopting such a game as a first step. Players can learn the complex structure of disaster manuals by playing Sugoroku. These manuals cover material ranging from the first indications of earthquakes to dealing with refuges and mutual aid among municipal government officers. Since these manuals have a wide scope, it is barely possible to learn everything in them, or even to grasp the basics. An examination of the manuals shows that they describe time sequences and cross-sectional activities simultaneously.

The content of the game closely matches the crisis manuals for Kobe, which were written after the Great Hanshin-Awaji Earthquake. These manuals were ana-

lyzed and described using the IDEF0 modeling procedure (National Institute of Standards and Technology, 1993). Fundamentally, the game is based on this version of the manuals, rewritten using IDEF0, with some slight modifications to make playing the game more fun.

Another advantage of a gaming simulation is that once translated into a Sugoroku game and depicted on one board, it is easy to grasp and understand the overall situation at a glance.

We made a second computerized version of the ‘Search & Rescue’ game, which is depicted in Figures 2 and 3. Figure 2 shows the opening screen and Figure 3 shows one of the stages (Stage A in this case) as a player proceeds to the next step.

The structure of the game is exactly the same in both versions. However, the computerized version requires a deeper level of information processing and decision making by the player, because the screen limits the view of the player as compared with the board game.



Figure 2 Disaster prevention ‘Sugoroku’ on PC: The opening



Figure 3 Disaster prevention 'Sugoroku' on PC: Decision making process (Stage A)

The third version of the 'Search & Rescue' game, is a different game that is based on different material. From the outset, the game was designed for stand-alone use on a computer. As seen in Figure 4, the screen shows a map of a city (in this case Yokohama, Japan). The aim of the game is for the player to act as the commander of the fire department at the emergency operations center, and to extinguish fires after an earthquake efficiently and effectively, while rescuing people. This game can test the impact of a player's allocation of available resources and logistics planning; to successfully allocate resources and formulate a plan, players must scrutinize resource and logistics information carefully, as this information is not easily accessible or intelligible.

As may be imagined from the rough description, the game is intended to do more than simply improve strategic decision making, such as the allocation of resources and planning. It is also designed so that by experiencing failure players unconsciously learn the importance of information scanning and monitoring in planning triage and resource allocation. Although players are not told these secondary purposes explicitly, they ultimately learn of them through their experience.

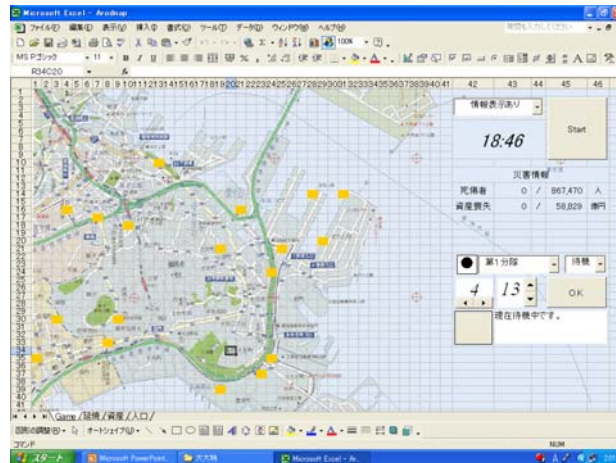


Figure 4 The ' Search and Rescue' game on PC

Conclusion

This paper explains three things. First, gaming simulation can play an important and promising role in disaster mitigation for both experts and lay people. Second, it proposes a tentative outline for understanding the role of gaming simulations and other instruction methods in disaster mitigation comprehensively. Finally, it briefly introduces three versions of a 'Search & Rescue' game that we have developed.

Since the 'Search & Rescue' game is still being developed, we would appreciate feedback from conference participants who try the game.

References

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